



MINISTRY OF CIVIL AVIATION

# Report of the Committee on Certification of Civil Aircraft and Approval of Equipment

AND MEMORANDUM BY THE  
MINISTER OF CIVIL AVIATION

*Presented by the Minister of Civil Aviation to Parliament  
by Command of His Majesty  
May 1949*

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NOTE.—The estimated cost of the preparation of this Report (including the expenses of the Committee) is £68 15s. 6d., of which £53 15s. 6d. is the estimated cost of publishing and printing this Report.



## MEMORANDUM BY THE MINISTER OF CIVIL AVIATION

In presenting this Report to Parliament, it is convenient to indicate the extent to which the Recommendations of the Committee, as summarised in Paragraph 42 of the Report, can be accepted by His Majesty's Government.

Recommendations 1, 2 and 3 are accepted in principle and the Air Registration Board will be guided by these recommendations in regard to new aircraft types now being developed.

Recommendations 4-9 and 13 suggest changes in the organisation and financial structure of the Air Registration Board. These questions are still under examination.

Recommendations 10, 11, 12, 14, 15, 16, 17, 18 and 19 are accepted. Arrangements have already been made, in accordance with Recommendation 14, to substitute for the Daily Certificate of Safety, a Certificate which has a duration of a stated number of flying hours depending on the use to which the aircraft is put.

Recommendation 20 is accepted for application to equipment of a kind which might affect the safety of the aircraft.

*Thursday, 19th May, 1949.*

PAKENHAM.

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## **TERMS OF REFERENCE**

To consider, and make recommendations with regard to, the conditions of and procedure for the certification of civil aircraft and the approval of navigational and other equipment, whether airborne or on the ground, employed in their construction, operation and maintenance.



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# REPORT

To :—

The RIGHT HONOURABLE LORD PAKENHAM, Minister of Civil Aviation.

My LORD,

We have the honour to present the following report on the subjects that your predecessor referred to us for examination.

## INTRODUCTION

1. Our terms of reference, which were issued on 22nd September, 1947, were as follows:—

“To consider, and make recommendations with regard to, the conditions of and procedure for the certification of civil aircraft and the approval of navigational and other equipment, whether airborne or on the ground, employed in their construction, operation and maintenance.”

2. The work of investigation was conveniently sub-divided under the headings of *Certification of Aircraft*, and *Approval of Equipment*. We decided that our task was not to investigate airworthiness requirements in detail, but to consider the broad principles and procedures by which the objectives of certification and approval can best be achieved.

3. We have held 26 meetings and have sought information and expressions of opinion from 26 organisations, including air transport operators, constructors, private flying interests, organisations of skilled technical staffs, and government departments. In addition, we have orally examined 29 witnesses and have secured information on the certification system followed in the United States of America. These user organisations and witnesses are listed at Appendices A and B.

## THE CERTIFICATION OF AIRCRAFT

4. In approaching this problem we were very conscious of the importance of adequate airworthiness arrangements to the safety of the public. The airworthiness regulations and requirements in force when you appointed us had been evolved gradually over the years since the first World War. The administrative organisation was based on the findings of the Gorell Committee in 1934,\* which had been implemented in 1937. It was necessary for us to ascertain how far the arrangements then proposed were adequate for both present-day conditions and conditions likely to obtain in the future. This entailed a close examination of the present situation and a gathering together of opinions, both on present arrangements and on future needs, from responsible persons and organisations with knowledge of the air transport industry. Except where stated otherwise, our recommendations on this subject relate solely to the certification of aircraft intended for use in public transport.†

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\* Cmd. 4654 (H.M.S.O. Price 1s. 3d.).

† Note:—“Public transport aircraft”, as defined in the Air Navigation (Consolidation) Order, 1923, means “aircraft carrying passengers or goods (including mails) for hire or reward or, in a case where the carriage is effected by an air transport undertaking, whether for hire or reward or not . . . .”



### *Object of Certification and Adequacy of Flight Trials*

5. The truism, that the object of certification is to testify that an aircraft is airworthy, is meaningless unless "airworthiness" as certified is specifically defined. We have therefore defined "airworthiness" as meaning "safety from the point of view of the structure, handling qualities and performance of an aircraft when used on appropriate duties by competent operators". Judging by this criterion, we do not consider that the trials required for certification purposes have always been adequate. Up to the present, flight trials required by the Air Registration Board have been limited to those necessary to ascertain whether an aircraft complied with current airworthiness requirements, and, among other things, to provide such performance data as were required to be entered on the certificate of airworthiness. The trials have not always taken account of the conditions in which the aircraft might have to be operated. We are strongly of the opinion that before a new type of aircraft is certified for the carriage of fare-paying passengers, its performance should have been ascertained to be adequate for safety in the operating conditions it may reasonably be expected to encounter in service. We reached this conclusion independently, but it is pertinent to observe that similar suggestions have been contemplated by the Air Registration Board, and that the general principle is in line with the discussions of the International Civil Aviation Organisation. (I.C.A.O.)

### *Basis of Certification*

6. In our view the following categories of trials should be carried out before a prototype transport aircraft is certified as airworthy for the carriage of fare-paying passengers :—

- (i) \*Functional trials of the airframe, engines and instruments ;
- (ii) \*Basic performance trials, including air handling, to ascertain if the aircraft conforms to the airworthiness regulations applicable ;
- (iii) Extended flight performance trials, where necessary, to provide sufficient data on the performance of the aircraft under various climatic, atmospheric and operating conditions to indicate whether the aircraft can be safely employed on any particular route. These data would be included in the Aeroplane Flight Manual described in paragraph 11 below.
- (iv) Intensive endurance flying, if the aircraft or power plant is unconventional or involves new design features. This flying should be carried out in conditions as close to operational as practicable, and should be aimed at testing reliability during the early period when defects are likely to arise. It may be partly or wholly combined with the trials in (iii), and the extent of the flying required for each aircraft should be determined in the light of the particular safety, economic and other factors involved.

7. The extent of these trials would depend on whether the constructor wished the aircraft to have a general certificate of airworthiness or one restricting its use to certain conditions (e.g., in temperate climates, etc.). An aircraft ordered by one of the airline Corporations might have to be sufficiently tested in real or simulated conditions approximating to those it would encounter on the routes on which it was intended for use. If the aircraft were a private venture aircraft, made for sale generally, the extent of the trials would depend on the scope of the certification that the constructor would require his aircraft to possess.

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\* NOTE:—These are included in the existing trials.



8. In order to ascertain an aircraft's performance in given circumstances it will not always be essential to fly the aircraft in that set of conditions, or on a particular route. We have received responsible advice that much of the performance data required can be calculated from tests carried out in this country, and this has an important bearing on the time and cost of testing generally. However, if an aircraft is required to be safe for use in especially severe conditions, e.g., for tropical, arctic or high altitude operations, it may well have to undergo tests in those conditions to check the accuracy of performance data calculated from the results of tests carried out elsewhere.

#### *Scope of Airworthiness Trials*

9. The trials described in paragraphs 6-8 above are required solely for certification purposes, and the responsibility for prescribing them in detail will rest with the Certifying Authority. They should not be confused with any tests that an operator makes in order to obtain information on purely operating problems such as those of maintenance, loading, refuelling, passenger comfort, and general running economics. These are an operator's responsibility, and the transfer of an aircraft to a new route, or the introduction of a new type of aircraft on an existing route, will only concern the Certifying Authority if the aircraft's performance in the operating conditions likely to be encountered on the route concerned has not been adequately ascertained beforehand. It is important that in this respect there should be a clear division of responsibility between the Certifying Authority described in paragraphs 14-23 of this report, the constructor and the operator.

10. The Certifying Authority must also be responsible for the supervision and co-ordination of the flight and other trials needed to ascertain if an aircraft is airworthy in the sense described in paragraph 5 above. It is essential that the constructor should participate fully in these trials—for example, in carrying out the tests under the supervision of the Certifying Authority—and that the industry as a whole should receive the benefit of such basic information as would affect the principles of design generally, and not the particular type under test alone. It is also essential that the operators should be brought in at the right stage of the trials, since not only can they contribute particular knowledge of the problems to be encountered, but they can also supply trained aircrew personnel whose experience will be a valuable supplement to that of specialized personnel engaged solely in test work.

#### *Provision of an Aeroplane Flight Manual*

11. At present, performance data for new types of aircraft are provided partly by the constructor, partly by the Air Registration Board (entered on the certificate of airworthiness) and, at times, partly by the Ministry of Supply. These data are not usually on a sufficiently extensive scale to embrace the entire operations for which an aircraft may be intended, and such additional data as are required have to be obtained by the operators themselves. We understand that the proposals for international adoption presently under consideration by the International Civil Aviation Organisation provide that for each type of public transport aircraft there should be an Aeroplane Flight Manual containing full information on the aircraft's performance in the operating conditions for which it is certified as airworthy. The Aeroplane Flight Manual would be issued with the certificate of airworthiness. We consider this proposal to be fundamentally sound. The provision of such data will be essential before an operator can decide if a particular type of aircraft can be operated on a given route in compliance with the



relevant British or foreign safety regulations. We are therefore of the opinion that the tests needed to provide the contents of the Aeroplane Flight Manual are an essential part of the airworthiness trials. As mentioned in paragraph 8 above, it is possible that the trials may also require test flights to be carried out over representative sections of the route or routes on which the aircraft will eventually fly in service. In such instances the flights should be a matter of arrangement and collaboration between the Certifying Authority and the air service operator or constructor concerned.

#### *The Present Air Registration Board*

12. Before making our recommendations on the authority to be responsible for certifying aircraft, it is pertinent to summarise the present arrangements and to review the change in circumstances since the inception of the Air Registration Board. The Air Registration Board was established in 1937 by the Secretary of State for Air, under Section 2 of the Air Navigation Act (1936), as a result of the report of the Committee appointed under Lord Gorell in 1934. The Gorell Committee recommended that the bulk of the work on the certification of civil aircraft should be removed from the authority responsible for military aircraft, i.e. the Air Ministry, and should be carried out by an organisation (the Air Registration Board) largely representative of, and financially supported by, the industry itself. To that end, the Council of the Air Registration Board was composed of four main groups, of which three represented respectively the operators, the constructors and the insurers. It was laid down that if a financial loss were incurred during the initial period, while the ideal of financial self-sufficiency was being approached, four-fifths of the loss would be borne by the Treasury, and one-fifth by the guarantors of the Board. The guarantors consisted of the three groups on the Council mentioned above, which therefore, had every incentive to establish an economical organisation and procedure. It was stipulated, however, that the amount of any losses borne by public funds would be limited to a total of £60,000, spread over the first five years of the Board's existence. This period expired during the war. Owing to the abnormal circumstances then prevailing, the original limit was not enforced, and financial assistance has been given by the Treasury on an ad hoc basis to the extent of some £220,000 in all up to the 31st March, 1948.

13. The main duties of the Air Registration Board at present may be summarised as follows:—

(i) To produce airworthiness regulations for the design, construction and maintenance of aircraft, engines, component parts and instruments.

(ii) To supervise the testing of new types of civil aircraft and, when satisfied, to recommend the issue of certificates of airworthiness for them.

(iii) To recommend the issue of certificates of airworthiness for new aircraft of existing types, and to supervise tests where necessary.

(iv) To recommend the renewal of certificates of airworthiness for aircraft that have undergone their annual overhaul.

(v) To investigate and, where desirable, certify construction and maintenance firms as being "approved firms", authorised to oversee and approve from the design stage their own construction and maintenance work, subject to such periodical checks (by the A.R.B.) as may be necessary.

(vi) To carry out examinations for licensed aeronautical engineers, and also the engineering parts of the examinations for commercial pilots' licences.



### *The Need for a new Certifying Authority*

14. The Air Registration Board was established to meet the needs of a situation in which British airlines were privately owned, civil aircraft were ordered and financed by private and commercial interests, international airworthiness requirements under the International Commission for Air Navigation were not nearly so detailed and binding as those proposed for adoption under I.C.A.O., and the airworthiness trials required were on a much smaller scale than today. At that time the Air Registration Board's certifying responsibilities were limited to aircraft carrying less than 10 passengers or with a gross weight not exceeding 10,000 lb., whereas in 1942 its responsibilities were extended by Order to civil aircraft of all sizes. Furthermore, neither the Ministry of Civil Aviation nor the Ministry of Aircraft Production (now amalgamated with the Ministry of Supply) were in existence in 1937 when the Air Registration Board was established. We consider that the Air Registration Board has rendered valuable service in discharging the duties laid upon it with the limited resources at its disposal. At the same time, after careful examination we consider that the composition and resources of the Board are not adequate for present and future needs.

15. It is our view that, for the reasons set out below, no civil aviation Certifying Authority can be expected to be entirely self-supporting financially at the present stage in the development of civil aviation. From the summary of its duties given in paragraph 13, it will be seen that the work of the Air Registration Board falls into two distinct categories. The first, corresponding to items (iii)-(vi) of paragraph 13, consists of work that can be costed and charged for commercially, and the expense involved is not likely to be so great as to be an unfair burden on industry. In our view such work should be charged for on a commercial basis, although we are aware that in some countries only a nominal charge is made for this particular work. The second category, consisting of items (i) and (ii) of paragraph 13, is virtually a national development charge for work comparable to that performed on other technical subjects to meet national requirements or to provide a basis for international agreement through the International Civil Aviation Organisation. It would be difficult, certainly as regards item (i) and probably as regards item (ii), to recover the cost from industry except by spreading it over items (iii) to (vi). There is little doubt that whether recovered directly or indirectly, the cost would add to the financial burdens of air service operations and might well prejudice the sale of British aircraft in foreign markets, since a proportion would have to be reflected in their price. Moreover it has seemed to us that, since the fundamental objective of surveillance is to ensure safety, not only for the travelling public but for the general public also, it is justifiable that, subject to adequate financial safeguards, a charge of this nature and magnitude should be borne by public funds.

16. We are unable to estimate precisely the extent of the expenditure that the functions and responsibilities of the Certifying Authority, as outlined earlier in this report, will involve. But taking into account the estimates we have received from the Air Registration Board and the wider responsibilities to be discharged by the new Certifying Authority, it seems that the annual sum required in future will probably be of the order of £250,000 and may well increase. If, as may be reasonably assumed from recent experience, the revenue of the Certifying Authority from fees charged for work done under items (iii) to (vi) of paragraph 13, including the increase in fees about to be brought into force, will amount to about £100,000 per



annum, there will be an annual balance of £150,000 to be met. For the reasons given in the preceding paragraph, we recommend that this charge should fall upon the Exchequer. In that event the Treasury may require greater control over the financial policy of the Certifying Authority than it exercises over the present Air Registration Board, but we hope that such control may be on a broad basis. It is our view that control should not extend to such detailed departmental supervision as would militate against the freedom of management and flexibility of action that are essential to the efficient performance of the duties in question.

17. We are unable to estimate the total cost of the trials that will be required for the purpose of certification. At present the flying and other costs are borne to a large extent by the constructor of the aircraft concerned, and recommendations under this heading would lie within the field of procurement of aircraft. At an earlier stage in our deliberations, we approached your predecessor for guidance as to whether we were to consider the problems of procurement that were inseparable from certain aspects of certification, and he instructed us that problems such as these would be outside our terms of reference. However, we feel it right to draw your attention to the fact that the degree of safety that can be secured from flight trials must depend to some extent on the amount of test flying that it is economically practicable to carry out. It cannot be wholly dissociated from the policy regarding production costs of new types of civil aircraft.

#### *The Proposed Authority*

18. We have given much thought to the question of whether there is need for a separate Certifying Authority or whether its work could be done more satisfactorily and economically by the Ministry of Civil Aviation or the Ministry of Supply. We are in favour of a separate Certifying Authority for four main reasons. Firstly we see no cause to depart from the principle set out in the report of the Gorell Committee, that the development of civil aircraft requires as much initiative and responsibility as possible to be left to the approved constructors and operators of aircraft, subject to such overriding safeguards as are reasonable. Secondly, we doubt whether there is any appreciable economy to be gained by adding this work to that already performed by the Ministry of Supply or the Ministry of Civil Aviation. Thirdly, the efficiency of the new Certifying Authority will reside not only in the high qualifications of its personnel, but also in the flexibility of its personnel arrangements. Fourthly, we feel that the work required can be discharged more effectively by a comparatively small body, concentrating on the objectives defined for the Certifying Authority, than by a section of a large Government Department, having responsibilities for many other matters besides those of civil airworthiness.

19. We therefore consider that a new Authority should be established, preferably as a reconstituted Air Registration Board, to take account both of the present situation and the fact that the future Authority will have to rely to a greater extent than its predecessor on support from public funds, with a consequent necessary change in the composition of its Council.

#### *Composition of the Authority's Council*

20. We are of the opinion that the members of the Council should be selected by the Minister of Civil Aviation, after consultation with appropriate bodies. They should not be the nominees of the various interests concerned in civil aviation but should be selected for their knowledge and experience of the particular profession, public body, or industry with which



they are associated. We consider that the Council of the Board might be composed of not more than 16 members, and might well include, for example, two professional pilots, one of whom should be an airline pilot of recent experience: two members having experience in the construction of aircraft: one experienced aeronautical maintenance engineer: one member with experience of navigational, radio and instrumental aids: two members engaged in air transport undertakings: two members engaged in aviation insurance: one member each from the Ministries of Civil Aviation and Supply: one member with experience of private and sporting flying: and two additional members, of whom one should be nominated by the Minister as chairman of the Authority. The Chief Executive of the Authority should be an ex-officio member of the Council and should be appointed by the Council. Members of the Council should be appointed for a period of three years, and should be eligible for re-appointment.

#### *Remuneration of Council Members*

21. Persons eligible and nominated as Council Members should not be obliged to refuse membership because regular absences from their usual business might impose excessive financial sacrifices. To meet such instances, we recommend that a suitable but moderate fee should be payable at the option of the member for each attendance at Council meetings. We also recommend that Council members should be reimbursed for travelling and subsistence expenses incurred by them in the course of their Council duties.

#### *Staff of the Authority*

22. It is essential that the staff of the Authority should be sufficiently expert and authoritative to be able to reconcile differences of opinion on aeronautical engineering problems, and should be adequate for the highly skilled work, not only of supervising and conducting practical tests, but also of evolving, after discussion with all concerned, the airworthiness regulations that must have an important effect on the civil aviation industry. The Chief Executive must be a person of standing and must be supported by fully qualified technical staff of the highest experience in the various specialised problems with which they will have to deal.

#### *Name of the Authority*

23. We recommend that use of the title "Air Registration Board" be retained. Although this title will not fully reflect the responsibilities that the new Authority will discharge, its use will emphasise the continuity of principle with that underlying the present Air Registration Board, and will preserve a title that has achieved international recognition in civil aviation.

#### *Relationship between the Certifying Authority and the Ministry of Supply*

24. Some witnesses have suggested that the relative responsibilities of the Ministry of Supply and the present Air Registration Board are ill-defined and that this causes over-lapping, confusion and delay. It is our view that, if there has been such uncertainty, it has arisen because the Ministry of Supply is not only a research organisation but has been a substantial purchaser of civil aircraft and, as such, has imposed requirements different from, or additional to, those required by the Air Registration Board. We consider that, if such difficulties should arise in the future, they will best be settled by consultation between the two bodies concerned. This should be facilitated by our recommendation in paragraph 20 that a Ministry of Supply representative should be included on the Council of the Certifying Authority. We believe that the relationship between the Certifying Authority



and the Ministry of Supply must be a close one and that, for many problems of research and development, the solutions of which are in the national interest, the Certifying Authority must continue to rely on assistance provided by the Ministry's technicians and its test and research establishments, the duplication of which would be impracticable and unnecessary.

#### *Co-operation with the Ministry of Supply Flight Testing Establishments*

25. As mentioned in paragraph 10, it is vital that a constructor should participate fully in flight trials of his aircraft. At the same time, we consider it important that every means should be utilised to support the continuous development of testing technique, to increase experience by conducting tests on difficult types extending beyond the minima currently required for certification purposes alone, and to make that experience and data available to industry in an integrated and co-ordinated form. The aim should be to create and maintain a corpus of knowledge on the advanced flight testing of civil aircraft, which, apart from its general value, is essential to the formulation of sound British policy prior to and during the conferences held by I.C.A.O. to reach agreement on international standards of airworthiness. We therefore recommend that full use be made of the Ministry of Supply's Flight Testing Establishments for this essential purpose. We recommend that the Ministry of Civil Aviation and the Certifying Authority should consult with the Ministry of Supply to ensure that the staff and facilities available for civil aircraft testing are sufficient for such tests to be carried out expeditiously and without the delays imposed by conflicting military and civil demands on personnel or items of equipment in short supply.

#### *Relationship between the Certifying Authority and the Ministry of Civil Aviation*

26. The Certifying Authority must be responsible to the Minister of Civil Aviation, but should enjoy the maximum independence in the fulfilment of its technical and administrative functions. We recommend that the Chairman should have direct access to the Minister.

#### *Co-operation with Constructors and Operators on both National and International Requirements*

27. Although previously we have referred only to collaboration between the Certifying Authority, constructors and operators on flight trials (see paragraph 10), this collaboration is, of course, equally important for the formulation and introduction of new airworthiness requirements, and in particular for those likely to be discussed at meetings of I.C.A.O. for eventual adoption internationally. It is clearly important to avoid the extremes either of accepting lower airworthiness requirements than are adequate for the highest practicable degree of safety, or of imposing requirements so stringent that they would oblige operators to withdraw aircraft from service long before the end of their economical life, and possibly before adequate replacements were available. It is therefore essential that there should be adequate consultation between the Certifying Authority, the Ministry of Civil Aviation, the constructors and the operators, in the formulation of British policy prior to international discussions on airworthiness.

#### *Daily Inspection Certificates and Renewal of Certificates of Airworthiness*

28. We have received evidence that there is need for a review of the conditions attached to the issue of Daily Inspection Certificates and the renewal of Certificates of Airworthiness. In particular, there is need to



consider whether the periods of validity of such documents should be for a fixed elapsed time or for a total flying time. In our view, these are matters of practical detail forming part of the certification procedure, and as such could better be considered by the Certifying Authority and other parties concerned.

#### *Certification of Private Aircraft*

29. We consider that private aircraft should continue to be certified and that the Air Registration Board should remain responsible. At the same time, airworthiness restrictions imposed on flying clubs and the owners of private aircraft should be reduced to a minimum. The Council of the new Authority should hold periodical consultations with user interests on the adoption of means to this end, for example, by the extension of the "Approved Inspection System" to flying clubs.\*

#### *Certification of Ultra Light Aircraft*

30. We understand that the Air Registration Board has already held discussions with the Ultra Light Aircraft Association regarding the practicability of devolving some measure of responsibility upon the U.L.A.A. for the approval of maintenance, repair and overhaul work carried out on the types of aircraft concerned. We have not examined the position in detail, as this will be more appropriate to the Council of the new Authority, but we consider that, within reasonable limits, the trend towards delegating responsibility to approved user interests is to be encouraged.

#### *Certification of Gliders*

31. It has been represented to us by gliding interests that only gliders used for paid instruction or for hire or reward should require certification and that other gliders should be exempt from this provided they complied with the rules of the British Gliding Association and with any arrangements required by the insurance companies. We consider that it would be premature at this stage to devolve the entire responsibilities of the Air Registration Board for survey and inspection upon the organisations and individuals concerned with the operation, maintenance and overhaul of gliders. Nevertheless, we believe that everything practicable should be done to avoid imposing restrictions on the gliding movement, and we recommend that the Certifying Authority should review the situation from time to time in consultation with the gliding interests, with the object of progressively relaxing its responsibilities for inspection and certification to such a degree as may be consistent with safety. Such consultations should be facilitated by the inclusion on the Council of the Certifying Authority of a member with experience of private and sporting flying, as recommended in paragraph 20 of this report. The devolution of responsibility for inspection and certification might be facilitated if a licence for Glider Maintenance Engineers could be introduced to meet situations in which the present requirement is for an Aircraft Maintenance Engineer holding "A" or "B" licences.

32. We emphasise that the above recommendations refer to gliders other than those used for paid instruction or hire or reward. We consider that the certification arrangements for the latter must be comparable to those for other aircraft used for the carriage or instruction of the public.

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\* NOTE:—We note that action to this end has now begun, following recent discussions between the Air Registration Board and the Association of British Aero Clubs.



## THE APPROVAL OF EQUIPMENT

33. In considering that part of our terms of reference dealing with the approval of equipment, we decided that the procedure for approval could be conveniently examined under the headings of *airborne equipment* and *ground equipment*. The latter can be sub-divided into equipment used for the respective processes of aircraft construction and maintenance, and of flight operation. We have not considered the aspects of approval that are covered by the Factory Regulations and as such are outside the terms of reference of a purely aeronautical Committee. With this reservation, our comments are contained in the following paragraphs.

### GROUND EQUIPMENT

#### *Equipment used in Aircraft Construction and Maintenance*

34. This equipment does not have to be approved aeronautically in the sense that the Air Registration Board approves materials used in the construction of an aircraft, but its general suitability, from the point of view of its effect on the safety of aircraft under construction or repair, is taken into account by the Board before recognising a firm under the "Approved Inspection System". We have received no evidence that the present system is unsatisfactory, and we recommend its retention by the new Authority, subject to such improvements as may be found necessary in future.

#### *Equipment used in Flight Operation*

35. This equipment consists mainly of radio navigational aids, radio and land-line communication facilities, refuelling and fire fighting equipment, aerodrome buildings, runways and aerodrome lighting installations. In the United Kingdom most of these facilities have been taken over or supplied by the Ministry of Civil Aviation, which operates and maintains them, and carries out its own inspections. In addition, it issues its own specifications for new requirements, which are to some extent determined by international agreement. In view of the international and national responsibilities of the Ministry of Civil Aviation for providing the ground services in which this equipment is used, we consider that the responsibility for approval of such equipment should remain with the Ministry of Civil Aviation.

### AIRBORNE EQUIPMENT

#### *Compulsory Equipment*

36. The carriage of certain flight and engine instruments, and of additional instruments for flight in specified circumstances, is made compulsory under the Air Navigation Directions and the Civil Airworthiness Requirements. Approval of the design, construction and installation of such equipment is a responsibility of the Air Registration Board. The Board discharges this responsibility in collaboration with the constructors and operators, for whom there is an "Approved Inspection System" similar to that obtaining for firms engaged in the construction and overhaul of aircraft. We have received no serious adverse criticism of the present procedure and we consider that any matters of improvement in detail can be left to the new Authority.

#### *Optional Equipment*

37. It is important that the carriage of instruments or equipment additional to those required by the regulations in order to obtain further experience with them or assistance from them, should not be discouraged. We therefore think it undesirable to insist that all instruments or equipment carried on an aircraft should be subject to certification. We consider that

the only certification required for optional equipment or instruments should be to ensure that its installation and functioning do not interfere with the accuracy and reliability of other equipment and instruments that are essential in the sense defined in the preceding paragraph. To avoid any confusion between certified and non-certified equipment when installed, we recommend that non-certified equipment should be distinctively labelled.

#### *Radio and Radar Navigational Equipment*

38. Under the present procedure the installation of radio apparatus in an aircraft has to be approved by the Air Registration Board, to ensure that the installation itself does not affect the aerodynamic and mechanical safety of the aircraft. The radio apparatus and its installation also have to be approved by the Ministry of Civil Aviation (Directorate of Telecommunications) to check that the equipment functions correctly (within its recognised degree of accuracy) when in the aircraft. We consider that this divided responsibility is undesirable in principle and can be uneconomical in practice. We therefore recommend that the inspection and certification of airborne radio apparatus, from the aspects of both installation and functioning, should be the responsibility of the Certifying Authority, and we recommend that the Ministry of Civil Aviation should consult with the Certifying Authority to this end. The Certifying Authority should also be responsible, in collaboration with the Ministry, for the approval of firms for design and inspection purposes. We recognise that the Certifying Authority will not be able to assume these responsibilities until it has obtained the requisite technical staff.

39. We consider that the Ministry of Civil Aviation should retain its present responsibility for giving type approval to prototype equipment. We recommend, however, that when specifications for new equipment are discussed, the Certifying Authority should collaborate from an early stage in order to facilitate the subsequent approval of the installation from the airworthiness aspect.

40. We have received a considered statement from the Radio Communication and Electronic Engineering Association on the procedure for the development and adoption of future types of radio navigational aids. Although we consider that this subject is outside our terms of reference, it appears of such importance that we have referred it to you direct.

#### CONCLUDING REMARKS

41. Throughout our work it was apparent that the efficiency with which a Certifying Authority discharged its responsibilities and its consequent influence on air safety was a vitally important factor in British civil aviation, not only nationally but in its effect on British prestige in aviation internationally. In reaching our conclusions as to the best means of securing a system of certification adequate to meet present and future needs, we have received valuable assistance from the industry, public bodies and individuals, who have supplied us with written and oral evidence. We wish to record our appreciation of the help they have given.



## SUMMARY OF RECOMMENDATIONS

42. The following is a summary of our main recommendations:—

### THE CERTIFICATION OF AIRCRAFT

(1) Before a new type of aircraft is certified as airworthy for the carriage of fare-paying passengers, it should be tested to ascertain that its performance is adequate for safety in all the operating conditions that it may reasonably be expected to encounter in service. (Paragraph 5.)

(2) The present airworthiness trials should be supplemented, where necessary, by extended flight performance trials and by intensive endurance flights. (Paragraph 6.)

(3) The responsibility for prescribing and supervising the tests required for certification purposes should remain with the Certifying Authority (see sub-paragraph 5 below), but constructors should participate fully in the trials, and operators should be brought in at the right stage. (Paragraphs 9 and 10.)

(4) The whole of the annual deficit of the Certifying Authority should be met from public funds. (Paragraph 16.)

(5) A new Certifying Authority should be established, preferably as a reconstituted Air Registration Board. (Paragraph 19.)

(6) The Members of the Council of the Certifying Authority should be appointed by the Minister of Civil Aviation for their knowledge and experience of civil aviation and not as nominees of the various interests concerned. A balanced composition is suggested in paragraph 20.

(7) Council Members should be appointed for a period of three years and should be eligible for re-election. (Paragraph 20.)

(8) Council Members should be reimbursed for travelling and subsistence expenses, and a fee for attendance at Council meetings should be payable at the option of members who might otherwise have to refuse membership for financial reasons. (Paragraph 21.)

(9) The staff of the Authority should be highly qualified and experienced. The Chief Executive should be a person of standing, and should be an ex-officio member of the Council. (Paragraphs 20 and 22.)

(10) The title "Air Registration Board" should be retained. (Paragraph 23.)

(11) The Certifying Authority should continue to rely on Ministry of Supply technicians and test and research establishments for assistance with research and development problems. (Paragraph 24.)

(12) Full use should be made of Ministry of Supply Flight Testing Establishments. (Paragraph 25.)

(13) The Authority should be responsible to the Minister of Civil Aviation, but as independent as possible in the fulfilment of its technical and administrative functions. (Paragraph 26.)

(14) The Certifying Authority should review the conditions of issue of Daily Inspection Certificates and renewal of certificates or airworthiness. (Paragraph 28.)

(15) Private and Club aircraft should continue to be certified, but airworthiness restrictions should be kept to a minimum. (Paragraph 29.)

(16) Devolution of responsibility for the inspection and certification of ultra light aircraft and private gliders should be encouraged. (Paragraphs 30 and 31.)

(17) A Glider Maintenance Engineer's Licence should be introduced. (Paragraph 31.)

(18) Gliders used for paid instruction or for hire or reward should be subject to the same certification arrangements as other aircraft used for the carriage or instruction of the public. (Paragraph 32.)

### THE APPROVAL OF EQUIPMENT

(19) The procedure for the certification and approval of equipment should remain substantially unchanged, but responsibility for the inspection and certification of the functioning and installation of airborne radio equipment should be transferred from the Ministry of Civil Aviation to the new Certifying Authority. (Paragraphs 34-35 and 37-39.)

(20) Optional airborne equipment should not necessarily be subject to certification, but non-certified equipment should be distinctively labelled. (Paragraph 37.)

43. We wish to say, as no mere formality, how much our work has been aided by the exceptional experience, skill and other qualities of our Secretariat. Mr. Stallibrass and Mr. Cochran, assisted by Miss Watson, have contributed in no small measure to the speed and ease with which the volume of both oral and written evidence has been handled throughout our twenty-six sittings and to the preparation and writing of the report: for their untiring and effective help we are sincerely grateful.

(Signed) W. HELMORE (*Chairman*).

C. A. B. WILCOCK (*Vice-Chairman*).

D. C. T. BENNETT.

FRANK BESWICK.

F. BOVENSCHEN.

H. G. BROTHERTON.

P. W. S. BULMAN.

W. S. FARREN.

ALLAN GORDON-SMITH.

A. G. LAMPLUGH.

LUCAS.

T. NEVILLE STACK.

C. O. STANLEY.

B. C. WESTALL.

OLIVER COCHRAN } *Joint Secretaries:*  
G. W. STALLIBRASS }

3rd June, 1948.



## APPENDIX A

### LIST OF ORGANISATIONS

FROM WHICH WRITTEN EVIDENCE WAS SOUGHT

Air Registration Board.  
 Airwork, Ltd.  
 Association of British Aero Clubs, Ltd.  
 British Air Charter Association, Ltd.  
 British Air Line Pilots Association.  
 British Aviation Insurance Co., Ltd.  
 British Aviation Services, Ltd.  
 British European Airways Corporation.  
 British Gliding Association.  
 British Overseas Airways Corporation.  
 British South American Airways Corporation.  
 De Havilland Aircraft Company, Ltd.  
 Guild of Air Pilots and Air Navigators of the British Empire.  
 International Aeradio, Ltd.  
 Lloyds Aviation Underwriters Association.  
 Lloyds Register of Shipping.  
 London Aero and Motor Services, Ltd.  
 Ministry of Civil Aviation.  
 Ministry of Supply.  
 Radio Communication and Electronic Engineering Association.  
 Radio Officers Union.  
 Royal Aero Club.  
 Skyways, Ltd.  
 Society of British Aircraft Constructors, Ltd.  
 Society of Licensed Aircraft Engineers.  
 Ultra Light Aircraft Association.

## APPENDIX B

### LIST OF WITNESSES

FROM WHOM ORAL EVIDENCE WAS RECEIVED

	<i>Representing</i>
Mr. P. A. Hufton, M.Sc., Superintendent of Performance and Handling Tests.	{ Aircraft and Armament Experimental Establishment, Boscombe Down.
Sir Frederick Handley Page, C.B.E., F.R.Ae.S., Vice-Chairman.	{
Mr. G. F. Johnson, C.B.E., Vice-Chairman.	{
Mr. R. E. Hardingham, O.B.E., A.F.R.Ae.S., Chief Executive and Secretary.	{ Air Registration Board.
Mr. J. Norman, F.R.Ae.S., Chief Surveyor.	{
Mr. J. G. M. Pardoe, A.F.R.Ae.S., Senior Surveyor (Equipment).	{
Mr. G. H. M. Miles, Vice-Chairman.	{ Association of British Aero Clubs, Ltd.
Wing Commander W. L. Gordon, Member of the Technical Committee.	{
Captain M. J. R. Alderson, Chairman of the Air Safety and Technical Committee.	{ British Air Line Pilots Association.
Captain T. H. Farnsworth, Member of the Central Board.	{
Mr. R. C. Morgan, Chief Project and Development Engineer.	{ British European Airways Corporation.
Mr. K. G. Wilkinson, Chairman of the Technical Committee.	{ British Gliding Association.
Mr. C. H. Jackson, B.Sc., A.C.G.I., D.I.C., A.F.R.Ae.S., Chief Project Engineer.	{
Mr. H. D. Strawson, O.B.E., Chief Maintenance Engineer.	{ British Overseas Airways Corporation.
Mr. J. W. Kenny, Technical Assistant to the Chief Executive.	{ British South American Airways Corporation.

*Representing*

Air Commodore W. P. G. Pretty, O.B.E., Director of Telecommunications.	}	Ministry of Civil Aviation.
Mr. J. R. Weaver, B.Sc., Directorate of Telecommunications.		
Mr. T. Paris, M.A., Head of Planning Division; Late Director of Finance (Ground).		
Miss J. A. G. Murfitt, Directorate of Finance (Ground).		
Mr. R. H. Walmsley, B.Sc., F.R.Ae.S., Director of Aircraft Requirements.		
Mr. F. F. H. Boxall, Directorate of Aircraft Requirements.		
Mr. E. L. Beverley, D.F.C., Directorate of Civil Air Operations.	}	Ministry of Supply.
Mr. A. E. Woodward-Nutt, B.A., F.R.Ae.S., Director of Civil Aircraft Research and Development.		
Mr. K. T. Spencer, M.C., B.Sc., A.M.I.C.E., A.C.G.I., F.R.Ae.S., Deputy Director of Aircraft Research and Development (Technical).		
Mr. J. D. North, M.I.Mech.E., F.R.Ae.S., Deputy Chairman of the Technical Board.		
Mr. C. C. Walker, C.B.E., A.M.I.C.E., F.R.Ae.S., Member of the Society.	}	Society of British Aircraft Constructors, Ltd.
Mr. J. D. Pearson, Wh.Sc., B.Sc. (Eng.), A.M.I.Mech.E., Member of the Society.		
Mr. H. W. Goodinge, Technical Secretary.		
Captain J. Meyersburg, Chief of the Flight Engineering Division.	}	U.S. Civil Aeronautics Authority (New York Region).



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